



United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA 22092

In Reply Refer To:
WGS-Mail Stop 590

10 JUL 1991

Memorandum

To: Assistant Division Chief for Production Management
Assistant Division Chief for Research
Assistant Division Chief for Information and Data Services
Acting Assistant Division Chief for Program, Budget and
Administration
Chief, Eastern Mapping Center
Chief, EROS Data Center
Chief, Mid-Continent Mapping Center
Chief, Rocky Mountain Mapping Center
Chief, Western Mapping Center

From: Assistant Division Chief for Coordination
and Requirements

Subject: Congressional Hearing on Landsat Program

The House Committee on Science, Space and Technology and Permanent Select Committee on Intelligence held a joint hearing on June 26, 1991, on "Military, Civilian, and Commercial Applications of the Landsat Program" (attachment). Dallas Peck testified on behalf of the USGS and the Department. His testimony is attached, and Larry Pettinger can provide you with copies of the other witnesses' testimony upon request. A brief summary of the hearing, prepared by Charlene Raphael, is also attached.

USGS also participated in a concurrent technology demonstration. We displayed several briefing boards with Landsat MSS data showing temporal changes associated with various environmental phenomena (Mount St. Helens, deforestation in the tropics, center pivot irrigation development, etc.). These examples demonstrated the importance of the historical Landsat archive for change detection; the boards are available from Larry Pettinger if you would like to use them. Several commercial vendors also presented Landsat-related digital image processing demonstrations.

Additional information about the hearing can be obtained by contacting the NMD staff who attended: Jim Plasker, Don Light, Charlene Raphael, Ron Wencil, Larry Pettinger, and myself.

Attachments

for *Richard L. Kleckner*
Gene A. Thorley

JUL 18 1991

IC 7-42

Action	
Info	
Watkins	<input checked="" type="checkbox"/>
Landis	<input checked="" type="checkbox"/>
Metz	<input checked="" type="checkbox"/>
DSB	<input type="checkbox"/>
CSB	<input type="checkbox"/>
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PD&CO	<input checked="" type="checkbox"/>
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Dist.	7/18/91

(1st 3 pgs.)

Dist.
6/28/91

Military, Civilian, and Commercial Applications of the Landsat Program
Technology Demonstration and Joint House Hearing
Cmte on Science, Space, and Tech. & Permanent Select Cmte on Intelligence
June 26, 1991, 10am to 2:20pm

-- Abbreviated Brief --

- Rep. Brown's opening statement on context of hearing:
 - This first of two hearings on the Landsat Program covers technical aspects. Hearing next month will cover policy and fiscal issues.
 - Inconsistent support and unreal expectations have plagued the Landsat program over the years. Issues remain as to whether
 - the level of funding and long-term commitment is available to sustain a continuing Landsat program in the current fiscal environment;
 - US can afford to lose satellite data market share and technological capability to foreign countries;
 - disparate and dispersed user community can be united to form a coherent constituency.
- Three panels discussed these Landsat issues:
 - Military Applications (DMA, DIA) -- DMA normally purchases \$1M to \$1.5M in Landsat data per year; have problems with Landsat's low spatial resolution, lack of stereo coverage and GPS; don't need Landsat's spectral capacity. DIA used Landsat/SPOT merges to support Desert Shield/Storm and generally wants any data they can get. SPOT data were used for the surgical strike that cut off the oil spill into the Persian Gulf. Impression that DOD generally supports Landsat, but not to the extent of wanting to be program manager or major \$ contributor.
 - Global Change Applications (USGS, CEES, U of NH) -- Group stressed need for routine (Fed policy before commercialization) rather than selected (commercial policy) imaging to maintain continuous record for long-term environmental monitoring. U NH focussed on need to maintain current sensor configuration (lower spatial resolution) for ongoing forestry applications. Rep. Wolpe questioned delay in release of CEES report on *Value of Landsat Data*. The report was entered into the hearing record and will be discussed further at the policy hearing.
 - Commercial Applications (EarthSat, ERDAS, Intergraph) -- Witnesses detailed value added industry's applications of Landsat data for Desert Storm, resource exploration, and environmental monitoring, and stressed the need for continuity of timely, low cost data (not necessarily 1 for 1 in sensor configuration). Noted that USGS carto. data are not current enough for their needs. None of the witnesses had problems with DOD as Landsat program manager (Rep. Valentine question); EarthSat stressed that the Federal Agency best able to manage the program is the one with the \$.

Summary Prepared by
Charlene Raphael

Congress of the United States
House of Representatives
Washington, DC 20515
June 11, 1991

Dallas L. Peck, Director
United States Geological Survey
U.S. Department of Interior
Reston, VA 22092

Dear Dr. Peck:

The Committee on Science, Space and Technology and the Permanent Select Committee on Intelligence will be holding a joint hearing on Wednesday June 26, 1991, on "Military, Civilian, and Commercial Applications of the Landsat Program." We extend a cordial invitation for you to testify before our two Committees.


The hearing will be held from 10:00 am until 1:00 pm in Room 2318 of the House Rayburn Office Building, and will focus on the current and anticipated applications of multi-spectral satellite imagery for a broad array of national and international objectives. The first panel of the hearing will address the uses of Landsat during Operation Desert Storm and will review the military and intelligence community's general requirements for this type of data in the future. The second panel will review the role of Landsat for global change and other scientific research. The final panel will focus on current and projected uses of Landsat data by the private sector. You would be participating in the second panel.

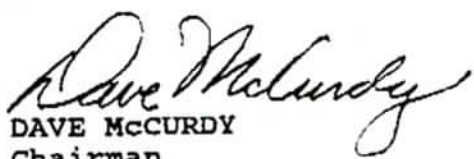
Your testimony should be limited to approximately ten minutes to ensure that Members have sufficient time for questions following presentation of statements. Your written statement may be of any length and will be included in its entirety in the published hearing record. You may also be asked during the hearing to respond to additional written questions for inclusion in the record.

Under the rules of our Committees, the proceedings of the hearings will be printed strictly in verbatim form. The testimony will be published as delivered; only typographical and transcriptional errors will be edited in the transcript.

If you have any questions, please do not hesitate to contact Pete Didisheim, at the Science Committee at (202) 225-6375, or Marijean Seelbach, at the Intelligence Committee at (202) 225-7690.

Sincerely,


GEORGE E. BROWN, JR.
Chairman
Committee on Science, Space
and Technology


DAVE MCCURDY
Chairman
Permanent Select Committee
on Intelligence

**MILITARY, CIVILIAN, AND COMMERCIAL APPLICATIONS
OF THE LANDSAT PROGRAM**

Joint Hearing
Committee on Science, Space, and Technology
Permanent Select Committee on Intelligence
June 26, 1991
Room 2318
10:00 am - 1:00 pm

PANEL I--MILITARY/OPERATION DESERT SHIELD APPLICATIONS

Maj. Gen. William K. James, USAF
Director, Defense Mapping Agency

Mr. D. Brian Gordon, Chairman
Tactical and Military Multispectral Requirements Working Group
Defense Intelligence Agency

PANEL II--SCIENTIFIC/GLOBAL CHANGE APPLICATIONS

Dr. Dallas Peck
Director, U.S. Geological Survey
Chairman, Committee on Earth and Environmental Sciences (CEES)

Dr. Robert W. Corell
Assistant Director for Geosciences
National Science Foundation
Chairman, CEES Working Group on Global Change

Dr. Barry Rock
Associate Professor
Complex Systems Research Center
University of New Hampshire

PANEL III--CIVILIAN/COMMERCIAL APPLICATIONS

Mr. David A. Thibault
Exec. Vice President, Earth Satellite Corporation

Mr. Steve Sperry
Manager of Marketing, ERDAS, Inc.

Mr. Lawrence F. Ayers
Vice President, International Marketing
Intergraph Corporation

TECHNOLOGY DEMONSTRATION -- ROOM 2325 9:30 AM -- 3:30 PM

Earth Satellite Corp.	Jet Propulsion Lab
ERDAS, Inc.	Terra-Mar
SPOT Image	USGS
EOSAT	ERIM
Intergraph Corp	

ATTENTION MEMBERS AND STAFF

**MILITARY, CIVILIAN AND COMMERCIAL USES OF SATELLITE IMAGES
TECHNOLOGY DEMONSTRATION**

Wednesday June 26, 1991

9:30 am -- 3:30 pm

Room 2325

- Come see images of Kuwait used during Operation Desert Shield
- See computer demonstrations of satellite image processing for applications such as:

Environmental ManagementDisaster PlanningCounter-NarcoticsMap UpdatingGlobal Change ResearchCrop ForecastingDetection of Military TargetsUrban PlanningOil and Gas ExplorationEconomic Intelligence

Special Attraction: Short computer-generated movies based on satellite data will be projected on a large screen video display in 2318 from 1:30 to 3:30 pm. These data simulation movies will include:

- Los Angeles: The Movie
- Kuwait City Flyover
- Monterey: The Bay

Technology demonstrations to be provided by:

Earth Observation Satellite Company (Lanham, MD)

Earth Satellite Corporation (Rockville, MD)

ERDAS, Inc. (Atlanta, GA)

ERIM (Ann Arbor, MI)

Intergraph Corporation (Reston, VA)

Jet Propulsion Laboratory (Pasadena, CA)

SPOT Image Corporation (Reston, VA)

Terra-Mar Resource Information Services (Mountain View, CA)

United States Geological Survey (Reston, VA)

Sponsored by the Science, Space, and Technology Committee

Testimony by Dallas L. Peck
Director, U.S. Geological Survey, Department of the Interior
Before the Committee on Science, Space and Technology and
the Permanent Select Committee on Intelligence
U.S. House of Representatives
June 26, 1991

INTRODUCTION

U.S. Geological Survey (USGS) involvement in satellite remote sensing began well before the launch of the first Landsat. Under the leadership of Director William T. Pecora, we provided the stimulus for an active program of remote-sensing research in the Department of the Interior (DOI), and played a major role in defining the Landsat technical specifications. In addition to being a major user of Landsat data, the USGS continues to play an important role in the Landsat program, with responsibility for processing, archiving, and distributing Landsat data, and for conducting a research and applications development program to encourage the use of Landsat data. To carry out this responsibility, we have worked closely with the National Aeronautics and Space Administration (NASA), which managed the Landsat program from 1972 until 1983, and the National Oceanic and Atmospheric Administration (NOAA), which assumed Landsat management responsibility in 1983. Now we work with NOAA and the Earth Observation Satellite (EOSAT) Company, the commercial Landsat operator, to manage the Landsat data archive and to assist in product generation distribution from the USGS Earth Resources Observation Systems (EROS) Data Center in Sioux Falls, South Dakota.

In the early years of the Landsat program, most of our cooperative research and applications development work was conducted with civilian agencies in the U.S. and other countries. In recent years, we have worked very closely with Defense and Intelligence communities for the purpose of meeting many information requirements such as terrain analysis, image mapping, and change detection. As a result, the USGS has played a significant role in meeting information requirements of the military users of civil satellite data.

The USGS continues to have a high degree of interest in the future of the Landsat program and supports the President's policy to continue the collection of Landsat-type data. USGS representatives are actively involved in interagency forums where the implementation of this policy is being debated. We have a long history of involvement with the Landsat program, and are interested in having continued access to Landsat data. We are prepared to play an appropriate role in assisting other agency and scientific users gain access to future Landsat data.

USE OF LANDSAT DATA WITHIN THE DEPARTMENT OF THE INTERIOR

A rich archive of Landsat data -- Multispectral Scanner (MSS) and Return-Beam Vidicon (RBV) data acquired over the last 19 years and Thematic Mapper (TM) data acquired for the last 9 years -- has provided the basis for many operational and research uses by the DOI. Examples of some of the most important USGS applications include the following:

Land cover mapping in Alaska has been completed for more than 250 million acres in cooperation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, the U.S. Forest Service, and the State of Alaska. The digital data from this program are being used effectively in geographic information systems to make a variety of land management decisions.

Wildfire monitoring, assessment of impacts, and recovery monitoring have been made in Yellowstone National Park using Landsat data collected during and after the massive fires of 1988 (in cooperation with the National Park Service).

Satellite image maps of U.S. and foreign areas have been made by digitally enhancing, geometrically correcting, and mosaicking Landsat data to produce base maps of large areas; often these are the most current maps available (in cooperation with the Department of Defense, Agency for International Development, and selected foreign governments).

The extent of deforestation in the tropics has been assessed using Landsat and NOAA's Advanced Very High Resolution Radiometer (AVHRR) data.

Urban area growth and the expansion of irrigated agricultural land (such as the development of center pivot irrigation systems) are monitored.

Monitoring changes in glaciers (including preparation of a Glacier Atlas of the World) and sea ice can be an important indicator of global warming.

The mineral assessment of the United States is aided by using Landsat data to identify and analyze potentially mineralized zones and rock alteration areas.

Landsat data are used for mapping and identifying geologic structure for hazard assessment, especially as it relates to earthquake, volcanic, and landslide hazards; this application is especially important as the world community recognizes the United Nations International Decade of Natural Disaster Reduction.

Assessing the impacts of volcanic eruptions such as that of at Mt. St. Helens in 1980 and monitoring the recovery of natural ecosystems of such areas are aided with Landsat data.

Research into the role of Landsat and Satellite pour l'Observation de la Terre (SPOT) data for map revision and satellite image mapping demonstrates the utility of Landsat data and the value of SPOT's higher spatial resolution and stereo imaging capability.

Production of Landsat image maps supports operational counter-narcotics efforts in the U.S. and in poorly mapped areas of South America where narcotic crops are grown.

Support for the Persian Gulf War included acquisition, reproduction, and distribution of Landsat digital data and film products; making special image enhancements for change detection, map updates, and terrain analysis; and providing operational support and training in image map production.

Post-Gulf war environmental conditions (oil spills, oil well fires, and disturbance of natural areas) are being assessed in cooperation with the United Nations Environment Programme (UNEP) - Global Resource Information Database (GRID) North American facility located at the USGS EROS Data Center, which provides links to international data centers and related data.

Several DOI bureaus, in addition to the Geological Survey, use Landsat data for a variety of other research and resource/land management applications. For example, the Bureau of Land Management is using Landsat and other remotely sensed data in its multiple-use management of public lands.

In addition to utilizing Landsat data in our operational and research programs, we are acquiring and archiving daily coverage of NOAA's AVHRR 1-Km data for much of the North American continent at our EROS Data Center. These data are used to produce bi-weekly vegetation greenness maps for government use in fire hazard monitoring and drought prediction programs, as well as to support research in land data set development for the modeling and prediction of global change.

USGS INVOLVEMENT IN LANDSAT SYSTEM OPERATION

The USGS continues to maintain the U.S. Government archive of Landsat data through direct appropriations to its annual budget. Recognizing the importance of long-term preservation of the Landsat archive for global change research and as a baseline for environmental assessment, the USGS is taking steps to convert the U.S. archive to a uniform, stable storage and reproduction media. This effort is essential because the data currently reside in different formats and on different media, and they are becoming unreadable due to tape degradation and processing system obsolescence.

Although EOSAT now processes and distributes all Landsat TM data orders through its facility in Lanham, Maryland, the USGS maintains the only system for processing Landsat MSS data at the EROS Data Center. This capability is especially important now because of NOAA's recently negotiated release from commercial marketing restrictions for all MSS data more than 2 years old, which includes over 95 percent of the MSS data in the U.S. archive. Access to these data at much lower prices (the cost of reproduction and distribution) will facilitate their use for global change research and other applications where comparison of current data with historical coverage is necessary. The USGS is developing a similar processing capability for Landsat TM data, in order to satisfy earth science needs for these data when commercial marketing restrictions begin to expire in 1994 for TM data more than 10 years old.

Over the life of the Landsat program, the USGS has made many significant contributions to improve Landsat data processing, image enhancement, and

inquiry/browse system capabilities. We are currently developing the Global Land Information System (GLIS), an on-line inquiry system to provide global change researchers and others with information about land-related global change data, including Landsat data. The GLIS prototype has just become operational and is now available to any user who needs access to land-related data. It includes the inventory of Landsat MSS data more than 2 years old as well as AVHRR data received at the EROS Data Center, and a few global data sets such as vegetation, soils, and cartographic data. As part of the GLIS development, information about the complete U.S. archive holdings of Landsat MSS and TM data will be available later this year, and the worldwide holding of the foreign Landsat ground receiving stations will be added in 1992.

On behalf of the civilian Federal Government agencies, the USGS administers a brokerage agreement with EOSAT to purchase Landsat data products and services. This service eliminates duplication and extra costs of making separate agency contracts. Federal agencies have purchased more than \$10.0 million worth of data through this agreement since 1986. The USGS also provides a similar service for purchasing SPOT and Soviet Sojuzkarta data, thus providing "one-stop shopping" for these different types of satellite data.

CURRENT ROLE IN LANDSAT SYSTEM AND PROGRAM DEFINITION

The USGS continues to represent the DOI in working groups and studies for the Landsat-6 follow-on system. We also participated on behalf of DOI in the National Space Council's study of future Landsat options that led to the President's decision to continue a "Landsat-type" capability.

The USGS is an active member of the Committee on Earth and Environmental Sciences (CEES) Task Group that is examining the value of the Landsat program to the U.S. Global Change Research Program. The Task Group's efforts have not been completed and are still under review within the Administration.

In our role as chairman of the Civil Applications Committee (CAC), the USGS provides an important interface so that civil Federal agencies can become aware and make appropriate use of DOD capabilities. The CAC serves as a mechanism for ensuring that civilian requirements for data and information are adequately represented in DOD planning.

The USGS is also participating in the development of NASA's Earth Observing System Data and Information System (EOS-DIS). The USGS EROS Data Center will serve as a Distributed Active Archive Center (DAAC), responsible for providing land-related data and information to the global change research community. We are building upon our Landsat experience to develop plans to interact effectively with the users; and to archive, reproduce, and distribute the greatly increased amounts of remotely sensed data to be acquired by EOS.

USGS ROLE IN LANDSAT FOLLOW-ON SYSTEM MANAGEMENT/OPERATION

Our long-standing participation in the Landsat program and close working relationship with DOD provide the basis for a continued USGS role in several management options for the Landsat-6 follow-on program. Regardless of the selected option, the USGS will continue to maintain the government's permanent long-term Landsat archive of existing data, and also address the issue of how data from commercially

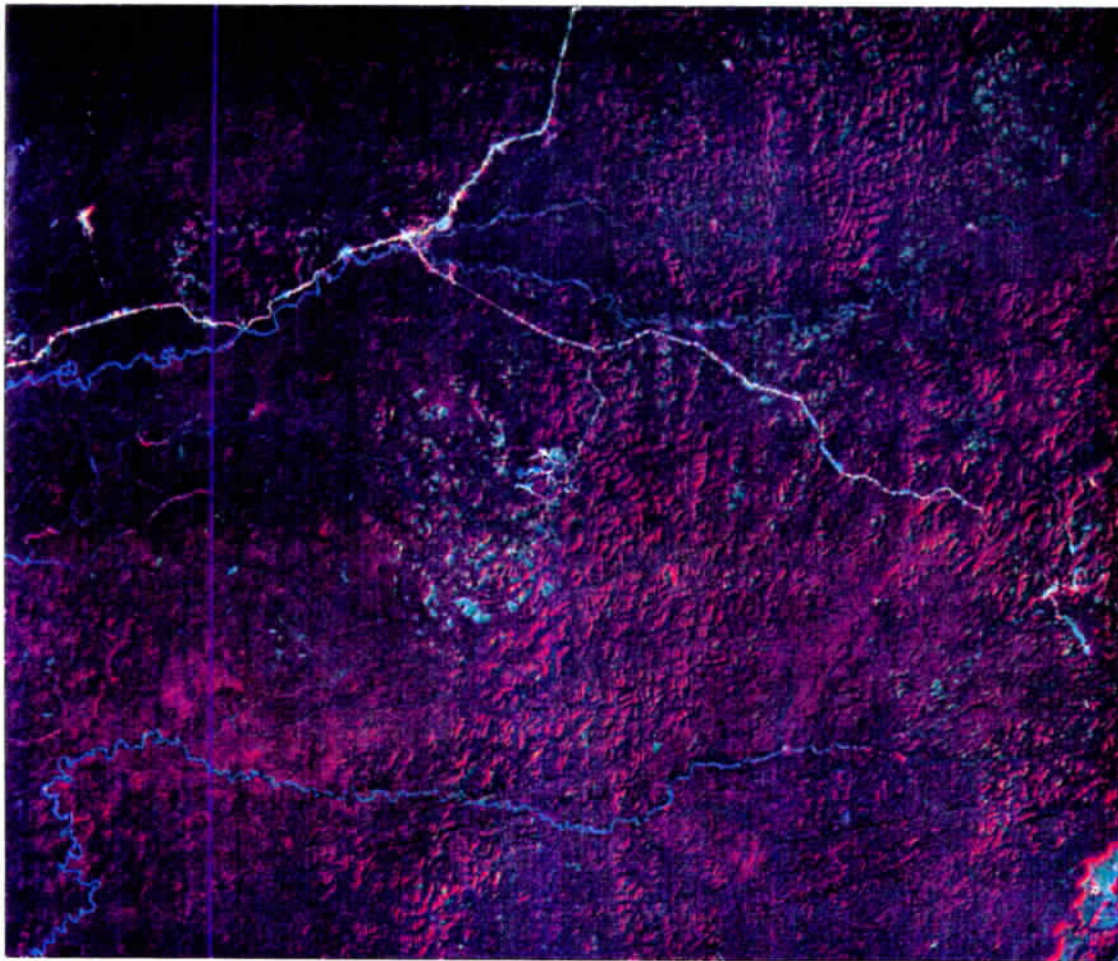
operated systems (such as Landsat 6 under EOSAT management, and SPOT) can be acquired and preserved for long-term use by government and civilian users.

The USGS will continue to provide a Landsat information and inquiry capability, using the Global Land Information System being developed as part of the U.S. Global Change Research Program. As the EROS Data Center expands its national and international data and information system linkages, it will identify more opportunities to provide information about and access to Landsat data. As an example, the EROS Data Center now houses the North American facility supporting the UNEP-GRID network, which provides an opportunity to exchange information about environmental data on a worldwide basis.

SUMMARY

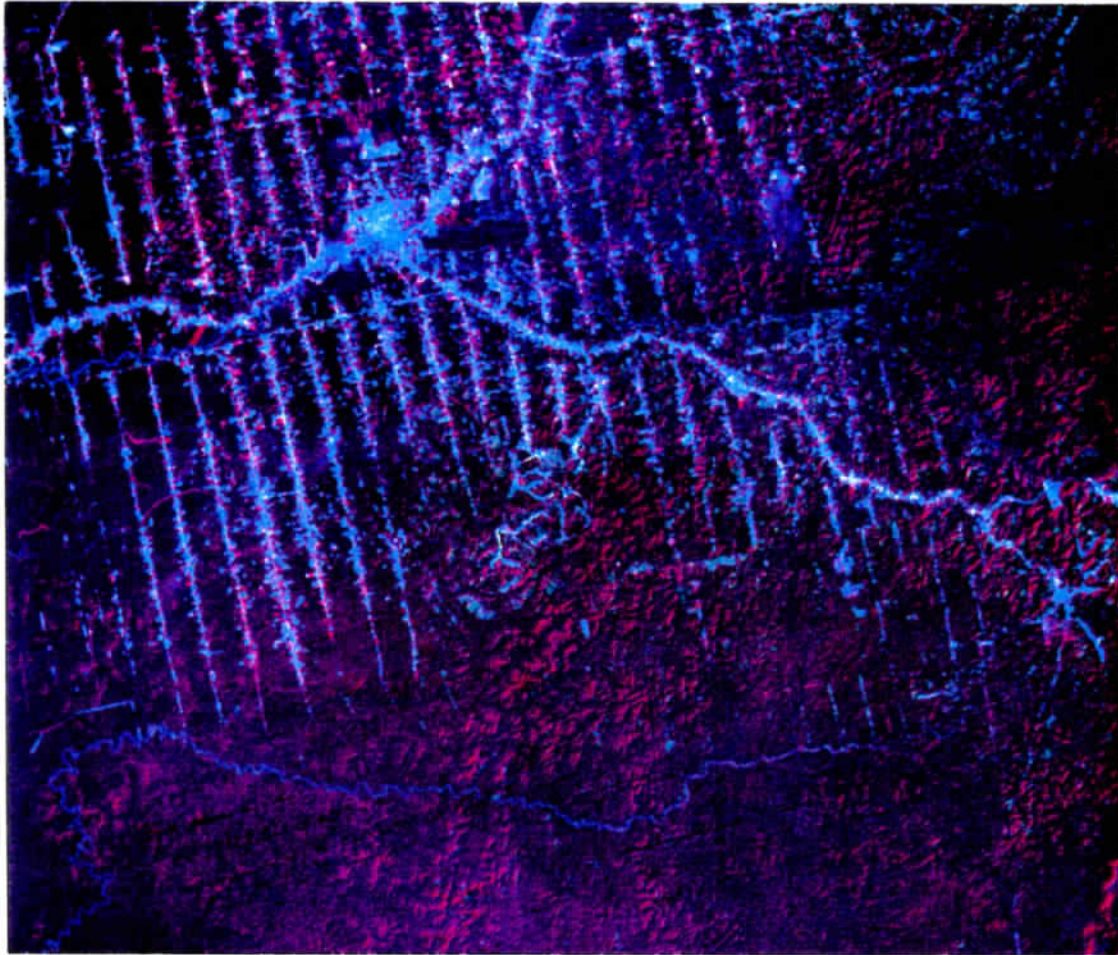
Thank you for the opportunity to express the views of the USGS on this important subject. I hope that my comments, and those of my colleagues, will be useful as Congress considers issues related to continuity of the Landsat-type data beyond Landsat 6. We have demonstrated that Landsat data serve important domestic, national defense, and international programs, and that the public benefits from the use of Landsat data in these programs. The President's policy to ensure the continuity of Landsat-type data supports these needs. The USGS is prepared to participate in the implementation of the policy.

Illustrations Accompanying
Testimony by Dallas L. Peck
Director, U.S. Geological Survey, Department of the Interior
Before the Committee on Science, Space and Technology and
Permanent Select Committee on Intelligence
U.S. House of Representatives
June 26, 1991



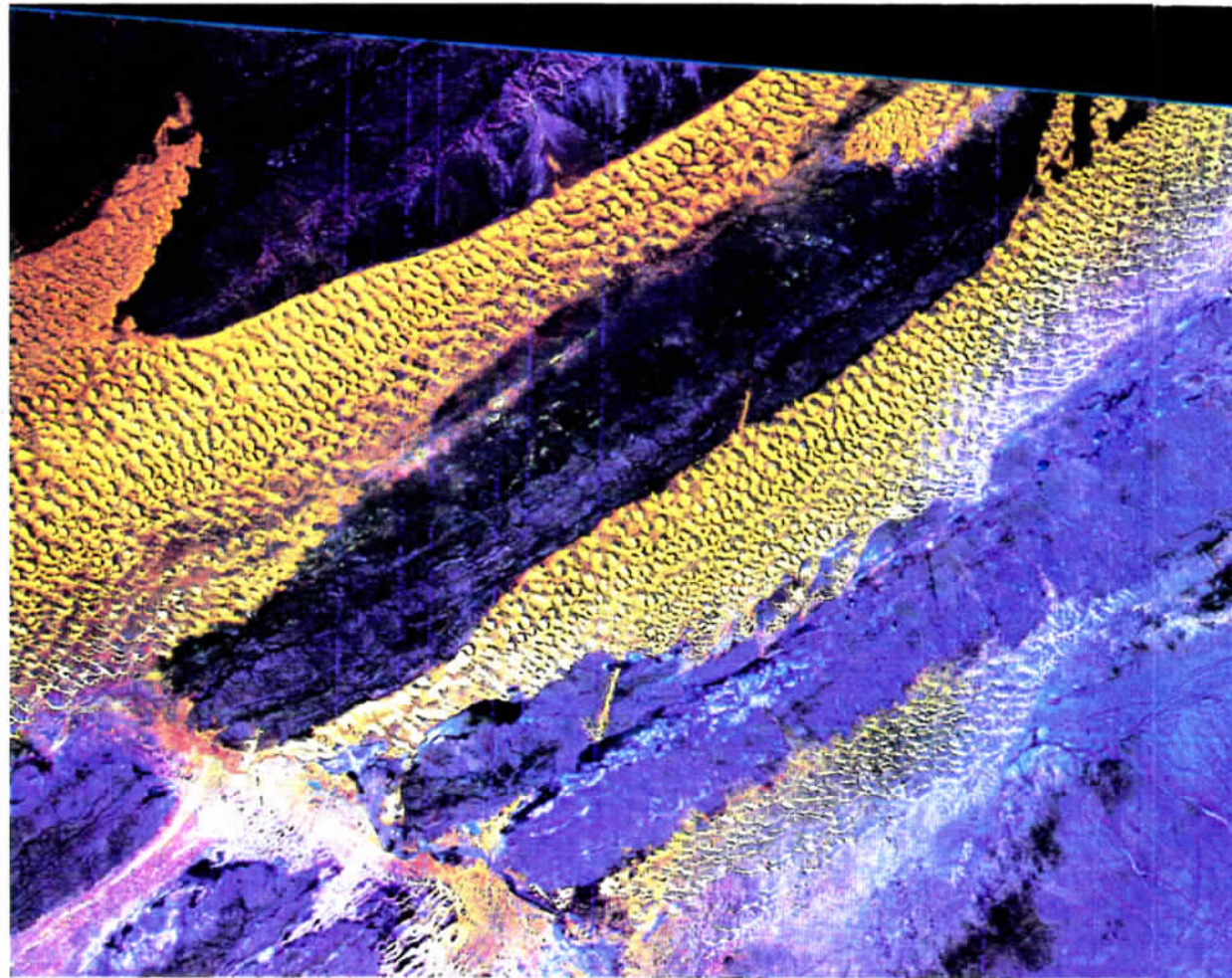
June 19, 1975

Scale: 1/1,000,000

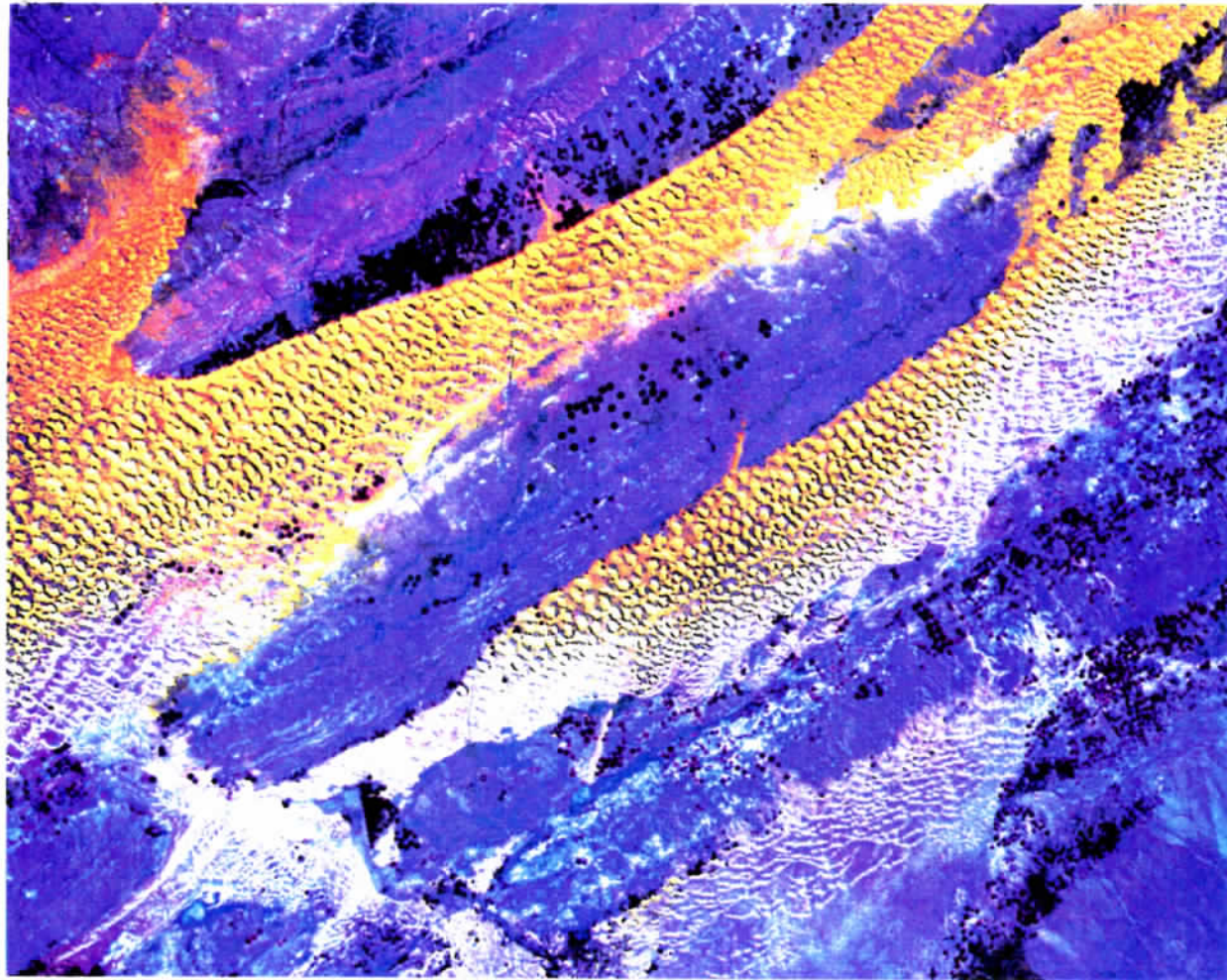


August 1, 1986

Figure 1. These Landsat MSS images from the state of Rondonia, Brazil show the deforestation that has taken place between June 19, 1975, and August 1, 1986. Forest clearing starts along main roads, and spreads out from systematic spur roads to create this characteristic pattern.



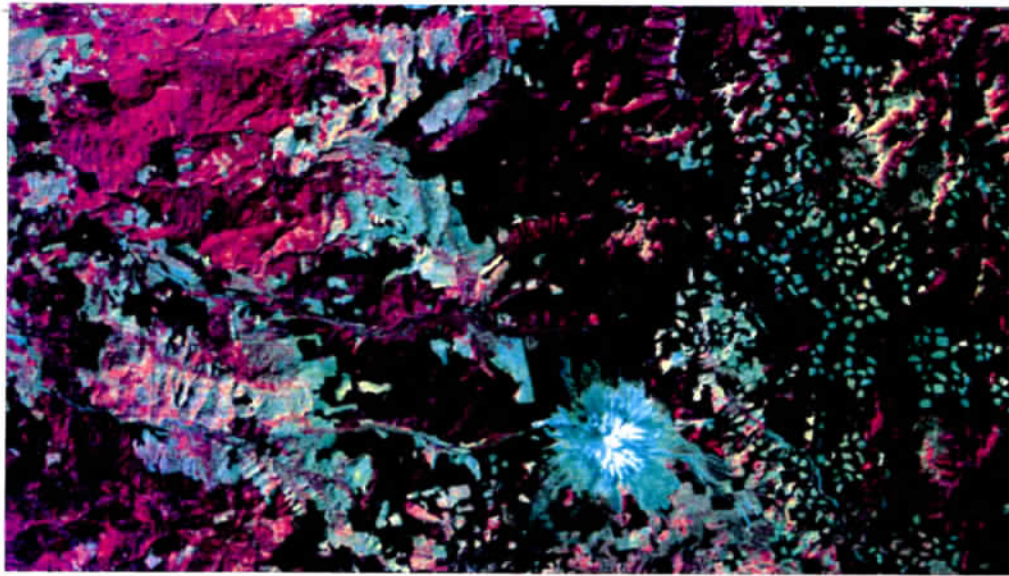
December 25, 1972



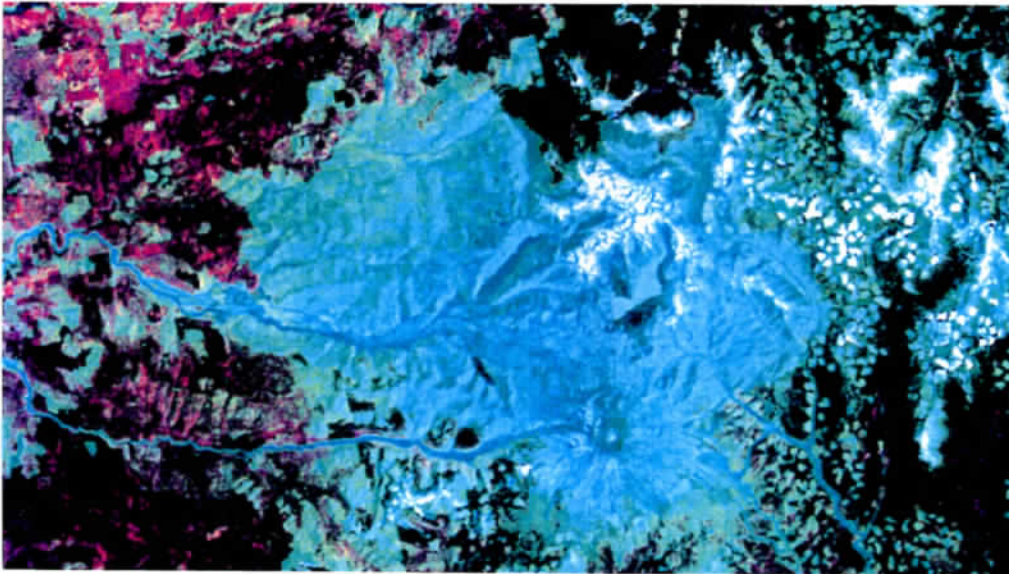
February 15, 1986

Scale: 1/1,000,000

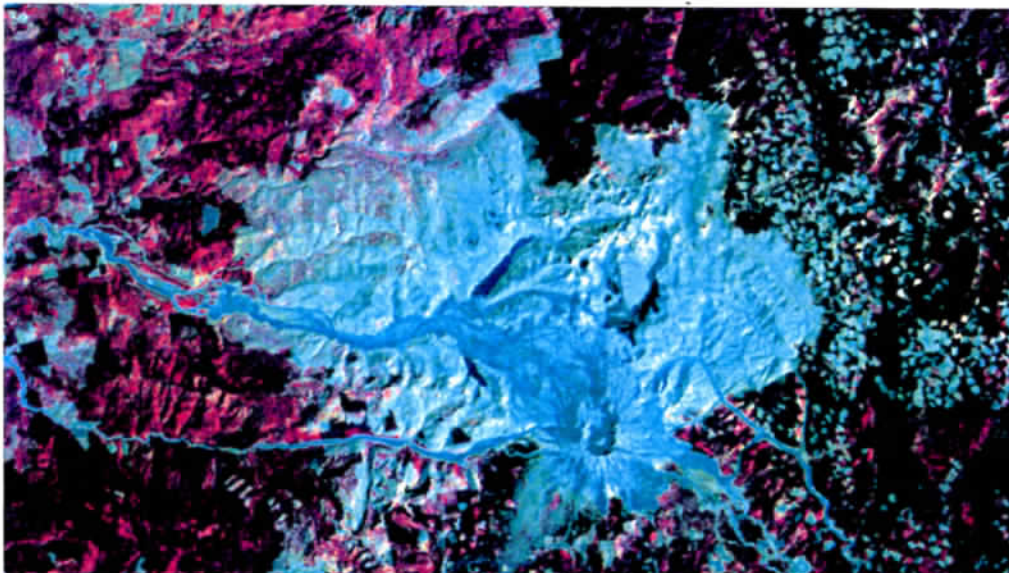
Figure 2. These Landsat MSS subscenes show the development of center pivot irrigation agriculture (the primary crop is wheat) northwest of Riyadh, Saudi Arabia. The new irrigation systems extend far beyond this pair of images, which show virtually no center pivots in 1972 (though traditional agriculture was practiced) to hundreds in 1986. Saudi Arabia has been withdrawing irrigation water from fossil aquifers since 1972 to increase agricultural production.



September 15, 1973



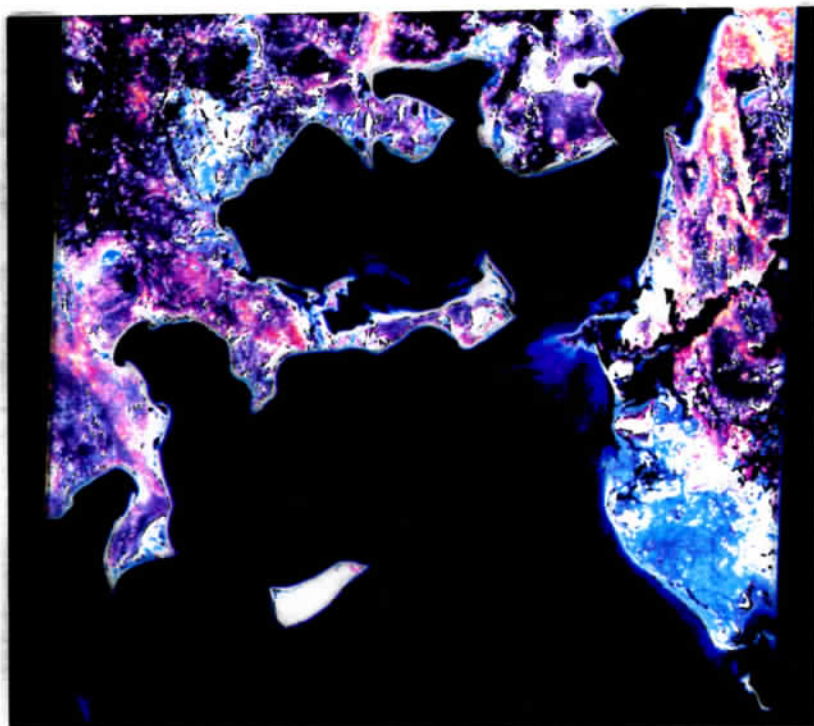
May 22, 1983



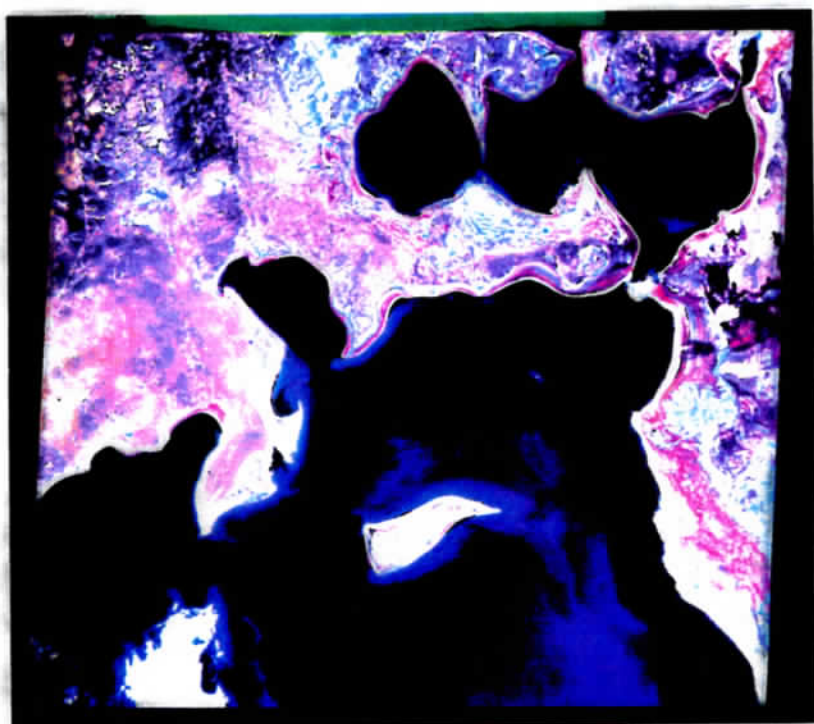
August 31, 1988

Scale: 1/500,000

Figure 3. These Landsat MSS subscenes reveal changes that have occurred around Mount St. Helens, Washington in the last 18 years. The 1973 image shows the area before the eruption in May of 1980. The 1983 image shows the massive destruction caused by the eruption. Bluish-gray areas are mud slides and mud-laden rivers flowing down from the mountain. The 1988 image shows some vegetation regrowth (light pink color in areas affected by eruption). The checkerboard pattern in the forest areas on the right side of these images represents clear-cutting.



May 29, 1973



August 19, 1987

Scale: 1/1,000,000

Figure 4. These 1973 and 1987 Landsat MSS images show the rapidly receding shoreline of the northern part of the Aral Sea, a land-locked sea in the USSR. Since 1918, waters of the two tributary rivers have been used to irrigate millions of acres of agricultural land, which now contributes 90 percent of the Soviet cotton crop. Water salinity, pesticide pollution, climatic changes, and increasing disease are increasing in the area, and large storms of salt dust are spawned on the newly exposed shores of the shrinking lake. During this 14-year period, the Aral Sea dropped from fourth to sixth among the world's largest lakes; at this rate, it could disappear in 30 years.